Space Weather Technical Forecast

Issued on Saturday, 24 August 2024 at 12:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Moderate to High activity with further M-class flares expected, and a slight chance of X-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate activity in the last 24 hours, with seven M-class flares, including a peak flare of M5.1 at 23/2021 UTC, from AR3800. This region was the source of four of these flares, two from AR3801 and the most recent M-flare was from AR3796 in the centre disc.

There are eleven regions on the disc, with a number of these moderately sized and with some complexity. AR3800 seems to have simplified slightly in recent hours, with the spreading out of its intermediate spots leading to the loss of its delta spot. AR3790 in the southwest disc is the largest region on the disc and also has a a weak delta spot within its intermediates. Relatively limited flaring has occurred from this region so far, but given the complex structure this could potentially change. AR3796 in the centre disc is also has some complexity, with a mixed polarity beta-gamma configuration, and was the source of the most recent M-flare. While perhaps a little simpler in structure AR3799 in the southeast maintains a small reverse polarity spot ahead of its main negative trailer. All remaining spots on the disc are either smaller or comparatively magnetically simple.

Two CMEs of note were observed, both of which were filament eruptions from a similar location of the southwest disc. The first occurred just after 23/1330UTC which has been assessed as likely missing, passing south of Earth. The second occurred at 24/0400 UTC, and relevant imagery is awaited to conduct a proper analyses but assessments suggest that this CME will also pass below Earth's orbit.

Solar Wind / Geomagnetic Activity: Slow wind conditions dominated. Solar wind speed, as measured by ACE at L1, was background, between 300-400 km/s. Density was around or just below average. Interplanetary Magnetic Field (IMF), Bt, was Weak to Moderate, between 5-10nT. The north-south component, Bz, varied between -9nT and +5nT, but was predominately negative (southward). Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed at GOES16 was at background. The 24-hour fluence was below the Active threshold, with 1.28e6 integrated pfu observed at 24/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are expected with a slight chance of isolated X-flares.

Solar Wind /Geomagnetic Activity: The CME from the filament eruption near AR3794 just after 23/0100UTC has been assessed as passing mainly ahead of Earth, but with a chance of a glancing arrival late on day 3 (26 Aug). There are no other Earth-directed CMEs. Any influence from the northern coronal holes CH60/61 on day 1 (24 Aug) is now expected to be weak, with mainly slow wind conditions dominating. Mainly Quiet geomagnetic activity is expected, with a chance of a spell of Unsettled to Active Day 1 (24 Aug) from any fast wind influence and a slight

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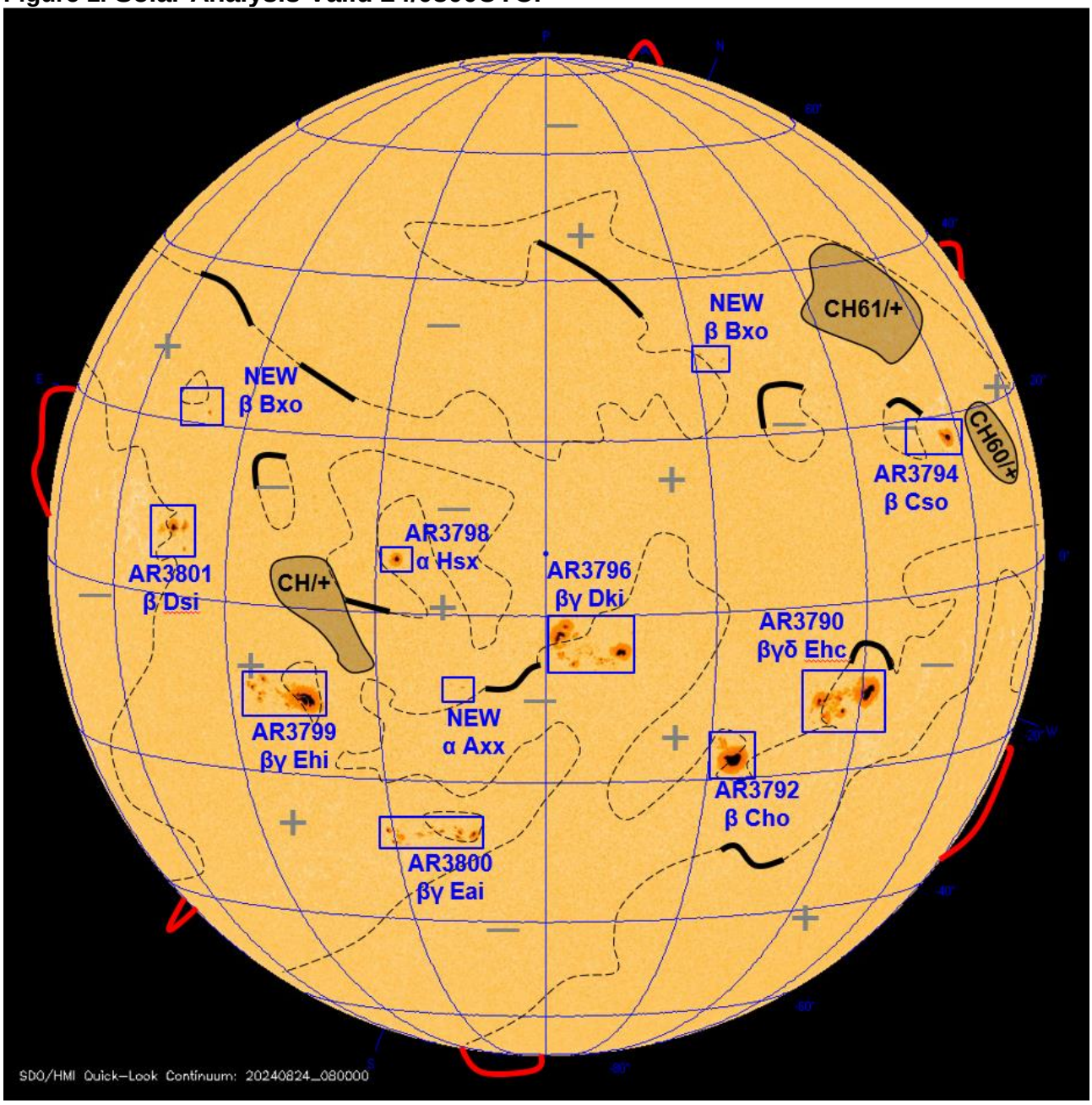
chance of Active to G1 Minor storms from any CME glance on day 3 (26 Aug).

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, but with the potential to rise in response to any notable flares, especially from AR3790 in the southwest, bringing a chance exceeding the S1/Minor solar radiation storm level should any notable flares occur. High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to persist below the Active level.

Figure 1. Solar Analysis Valid 24/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME from a filament eruption near AR3794 just after 23/0100UTC, has been assessed as passing mainly ahead of Earth, but with a chance of a glancing arrival late on Day 3 (26 Aug).

Otherwise mainly background slow wind conditions are expected. There is a weak coronal hole in the northwest disc, and this may bring a weak enhancement on Day 1 (24 Aug). However, MOSWOC Enlil suggested this connection would occur 24 hours earlier, so confidence is now very low for this to occur. No other notable enhancements are currently forecast, despite the slight enhancement indicated in MOSWOC Enlil from Day 3 (26 Aug) onward.

Mainly Quiet geomagnetic activity is expected, but with a chance of Unsettled to Active spells with any coronal hole sourced enhancement Day 1, and a slight chance of Active to G1 late Day 3 or early Day 4, (26-27 Aug), if any CME glance occurs.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/0858	Nil	Filament+C5.6 flare	NW AR3794	416km/s	Missing	Chance of glancing impact late 26Aug/Early 27 Aug

Figure 2: MOSWOC ENLIL with ensemble showing potential glancing CME later 26 Aug or early 27 Aug.

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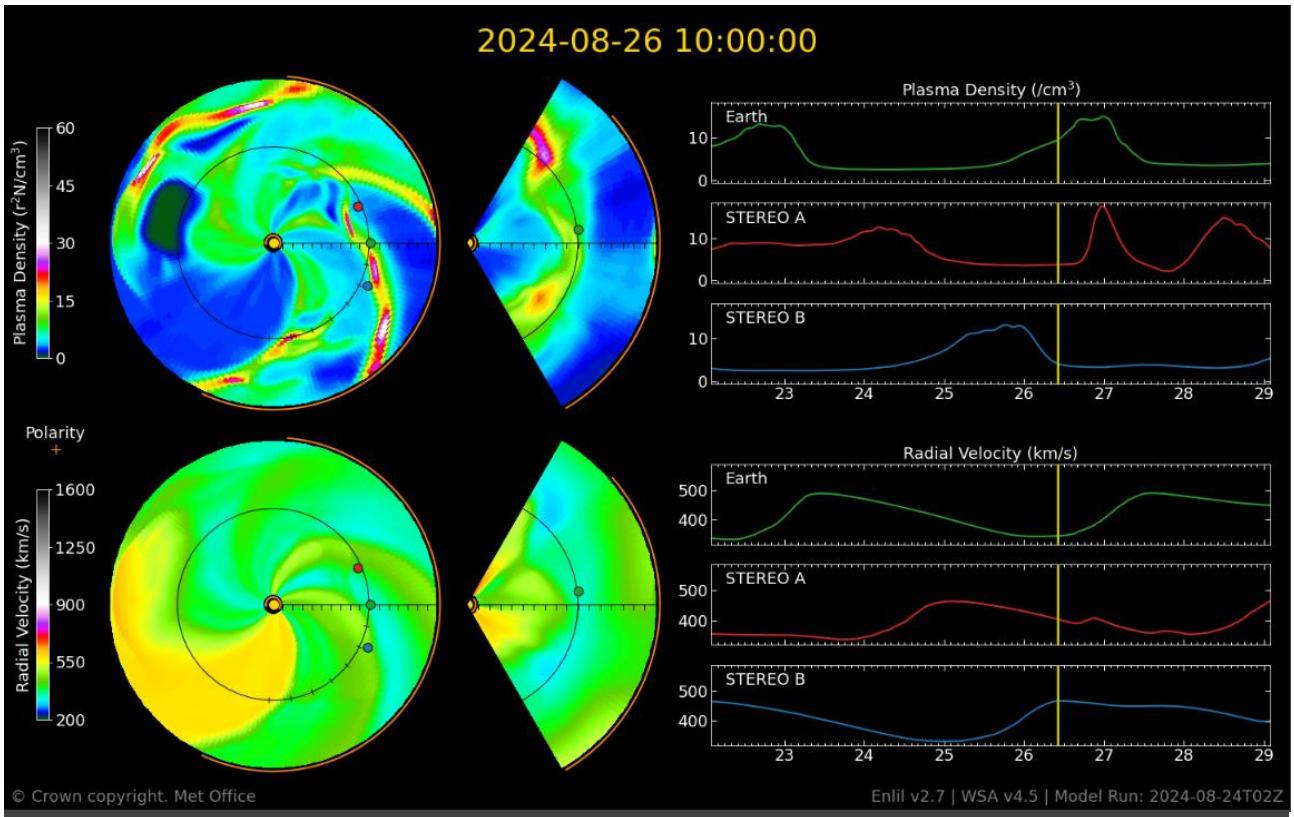

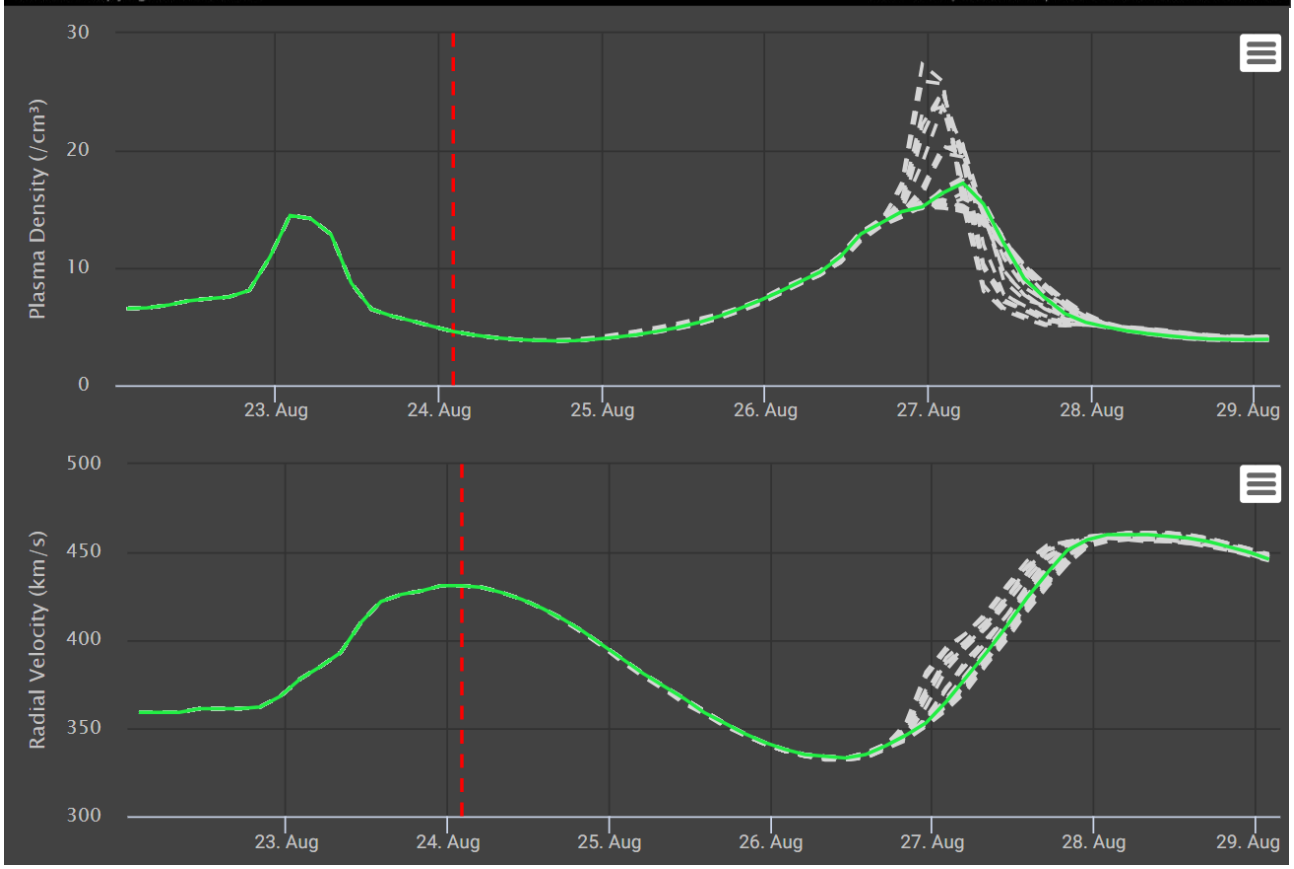

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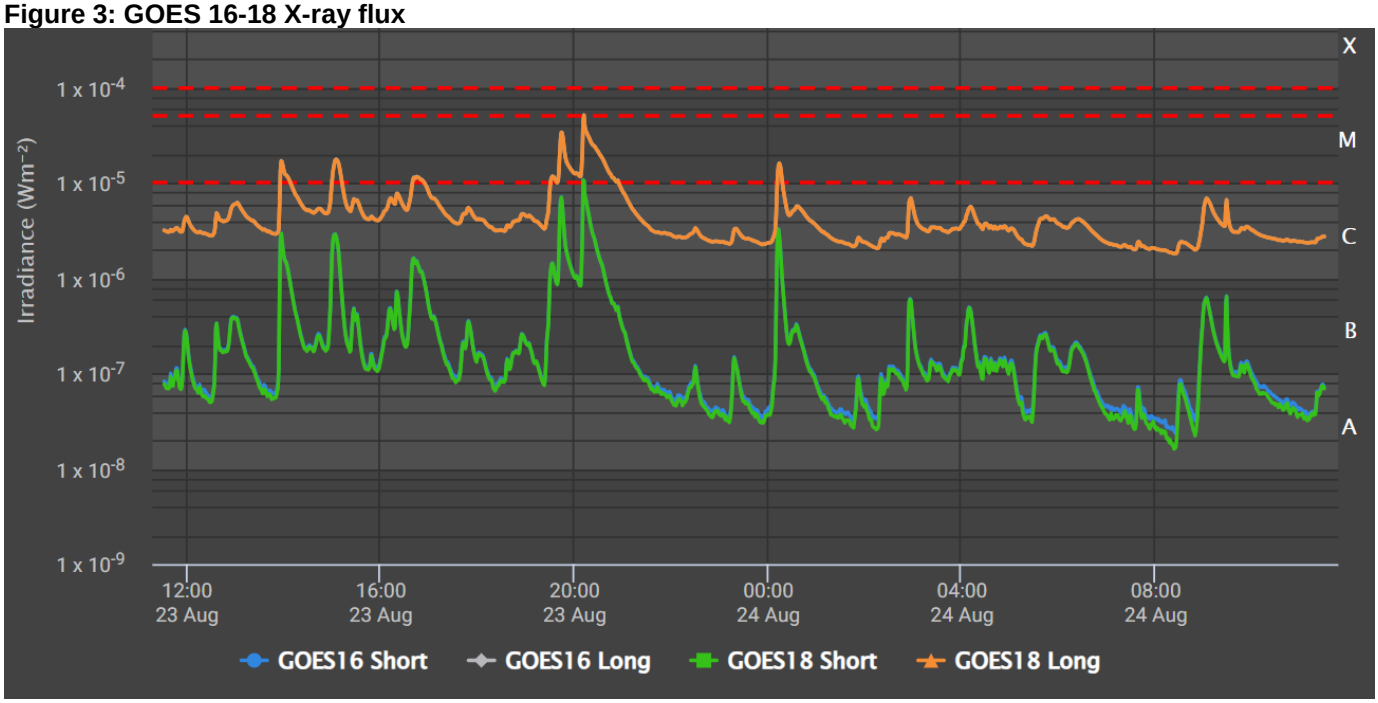
Radio Blackouts - X-Ray Flares:

There are eleven regions on the disc, with further M-flares expected and a slight chance of X-class flares.

AR3800, which has been the most active region, seems to have simplified slightly in recent hours, with the spreading out of its intermediate spots leading to the loss of its delta spot. AR3790 in the southwest disc is the largest region on the disc and also has a a weak delta spot within its intermediates. Relatively limited flaring has occurred from this region so far, but given the complex structure this could potentially change. AR3796 in the centre disc is also has some complexity, with a mixed polarity beta-gamma configuration, and was the source of the most recent M-flare. While perhaps a little simpler in structure AR3799 in the southeast maintains a small reverse polarity spot ahead of its main negative trailer. All remaining spots on the disc are either smaller or comparatively magnetically simple.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	80	80	80	80
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: GOES 16-18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background. AR3790 in the southwest is currently the best connected and most likely source for any proton event, however despite the development of a delta-spot configuration this region has been relatively inactive with little history of notable flares, decreasing confidence. However, there are a number of other potential flare sources on the Earth-facing disc, and subsequent proton enhancement, especially as these move into the better connected western disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	20	20	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background and forecast to remain at this level. Any coronal hole solar wind enhancement on day one (24 Aug) is now forecast to be rather subdued, limiting the potential for any increases in the electron count at GEO.

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM is currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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